METHOD FOR PRODUCING A CONDUCTIVE COATING ON AN INSULATING SUBSTRATE

Field Of The Invention

The invention relates to a method for producing a conductive coating on an insulating substrate.

Background Information

In modern electronics, the trend is toward a greater and greater reduction in component sizes and toward the integration of passive components as well, so that existing requirements in terms of increasing integration density of integrated circuits can be met. One promising technology for achieving this goal is so-called low-temperature co-fired ceramic (LTCC), known for example from the periodical "productronic" 8, 1995, pp. 40 ff. LTCC refers to a glass-ceramic mixture that, together with metallization pastes made e.g. from Ag, AgPd, or Au, is fired at a relatively low temperature that is below the melting point of the aforesaid metals.

Summary Of The Invention

The approach to achieving the object of the present invention proposes a particularly simple and therefore economical method for producing a metal coating in the context of LTCC and ceramic substrates. Previously usual nickel and gold baths can be omitted, so that the process sequence becomes simpler and therefore also more reliable. The coatings produced using the method according to the present invention have proven to be outstandingly suitable for the production of bonding connections.

Brief Description Of The Drawings

Figure 1 shows a substrate coated locally with a layer of a first metal.

Figure 2 shows the seeding of the layer of the first metal with a second metal.

Figure 3 shows the substrate with a layer of the second metal on the layer of the first metal.

Figure 4 shows the substrate with a metal coating after a firing operation.

Figure 5 shows a flow chart depicting the process sequence.

Detailed Description

The method is based on an electrically insulating substrate 1 that is coated locally with a layer of a first metal 2 (Figure 1 and step 20 in Figure 5). A substrate made of conventional ceramic is suitable as substrate 1. A substrate made of LTCC, however, is particularly well suited. Silver, in particular, is suitable as the first metal. First metal 2 is structured in such a way that is only locally covers at least one main surface of substrate 1. In particular, the layer made of first metal 2 has the structure of conductor paths that extend on a main surface of substrate 1. In a following method step (step 21 in Figure 5), the electrically insulating substrate 1 coated with first metal 2 is first thoroughly cleaned. A standard cleaner that is usual in electroplating technology, intended to eliminate troublesome contaminants on the surface of the substrate, is used for this cleaning. A cleaner with sodium acetate trihydrate has proven particularly well suited. In the next method step (step 22 in Figure 5), a seed layer 3a (Figure 2) of a second metal is applied onto the cleaned surface of layer 2. Palladium is preferably used for the seeding to produce seed layer 3a. This is deposited in electroless fashion onto the first metal. In practice, a thickness of a few atomic layers has proven useful in this context. In a subsequent method step (step 23 in Figure 5), a continuous layer 3b of the second metal is produced by further electroless deposition of palladium proceeding from seed layer 3a in Figure 2, covering the surface of layer 2 of the first metal on substrate 1. In this coating operation, a palladium layer is advantageously deposited at a ratio of 0.1 to 50%. In other words, after the diffusion operation the concentration of palladium present in the silver is from approximately 0.1 to about 50 percent by weight. An AgPd alloy having a palladium content greater than about 20-25% has proven particularly advantageous. This is because it offers particularly good corrosion protection and good resistance to silver migration. The leaching resistance in the solder bath is also distinctly better with an alloy of this kind than with a pure silver conductor path. This results in outstanding solderability. In a concluding method step (step 24 in Figure 5), coated substrate 1 is fired. The firing operation is performed at a temperature from 830 to 870°C, in particular at a temperature of 850°C. This firing operation is preferably performed in a continuous or batch furnace. What is created as the result of the firing operation is the layered structure depicted in Figure 4, in which layer 2

of the first metal (silver) is located on substrate 1, and in which a layer 3c of the second metal (palladium) is present on layer 2 of the first metal. A polished section of the layered structure shows that the firing operation does not result in a complete mixing of the silver of layer 2 with the palladium of layer 3b. Diffusion of the palladium into the silver layer is clearly evident from the polished section.

The layer produced using the method according to the present invention is outstandingly suitable as a contact surface for thin-wire bonding connections. It has been possible to produce extraordinarily reliable bonding connections using thin gold bonding wire (diameter 25 to 50 um). The bonding results are comparable to bonding on AgPd conductor path pastes.

An insulating substrate with a conductive coating produced using the method according to the present invention is thus made up of ceramic or LTCC with a conductive coating of silver and palladium, the palladium content of the conductive coating being between 0.1 and 50, in particular >20, percent by weight.

List of reference characters

1	Substrate
2	First metal
3a	Seed layer of second metal
3b	Layer of second metal
3c	Metal layer
20	First method step: preparing partially coated substrate
21	Second method step: cleaning
22	Third method step: seeding
23	Fourth method step: coating
24	Fifth method step: firing.